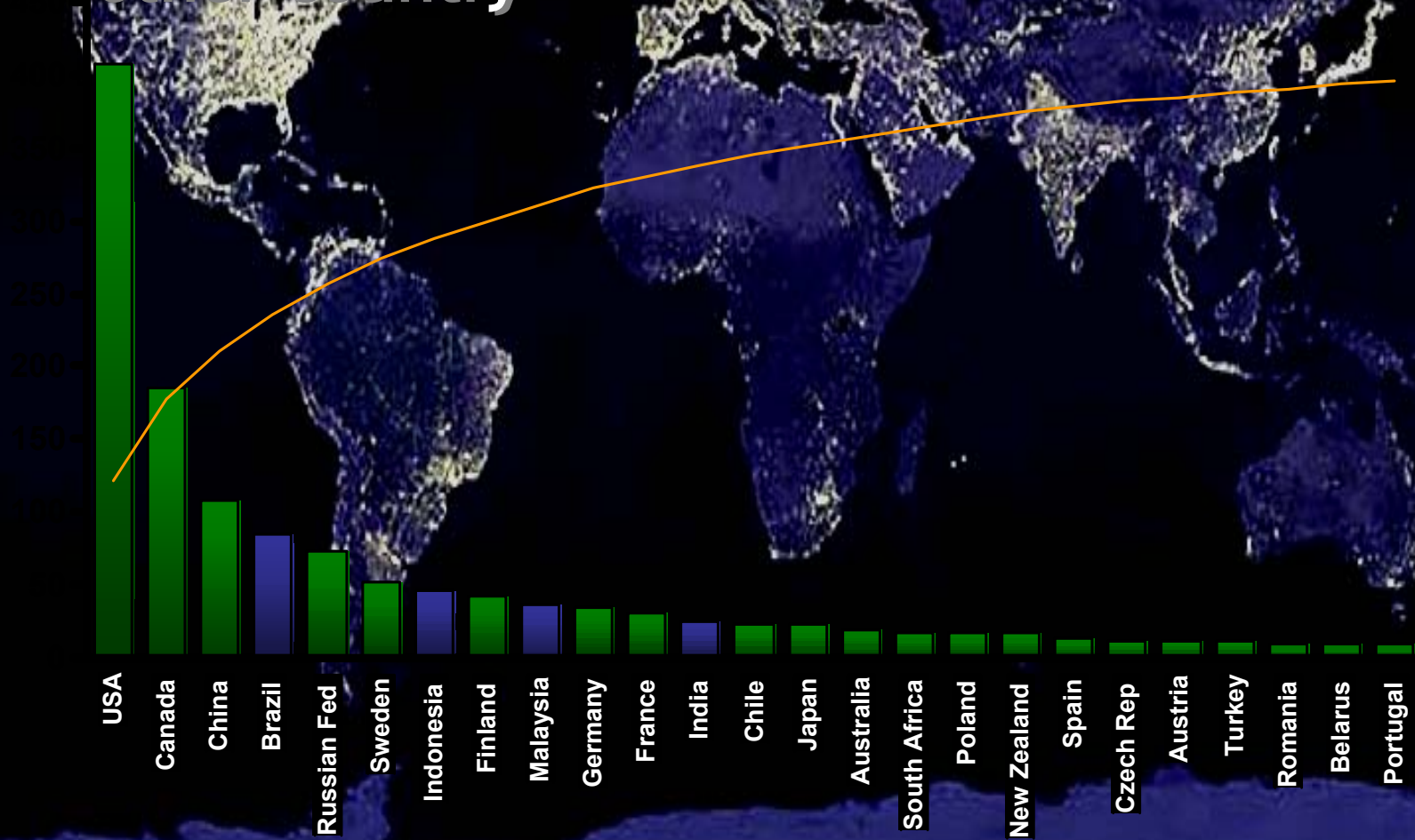


Forest Management Advisory Committee

Dr. Chris Risbrudt
Director
Forest Products Laboratory

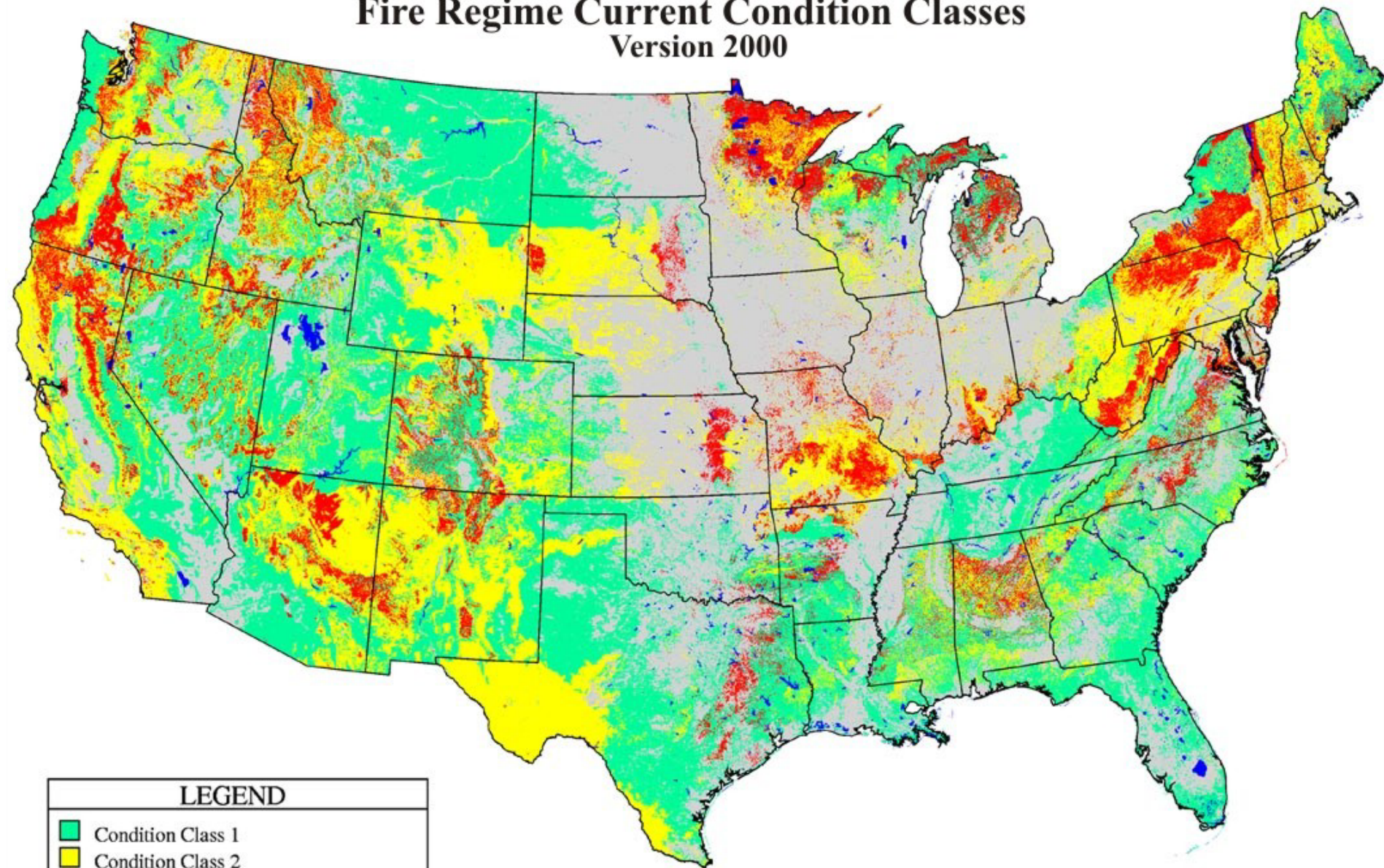


The United States produces a greater volume of wood as a material than any other country



Fire Regime Current Condition Classes

Version 2000



LEGEND

- Condition Class 1
- Condition Class 2
- Condition Class 3
- Water
- Agriculture & Non -Vegetated Areas

Small-diameter timber



Finding valuable uses for small-diameter timber benefits the environment and the economy.

Engineered wood products



Engineered biocomposites



Biocomposites promote sustainable forestry by using renewable, recyclable resources to create high-performance, high-value products.

Composite shingles



Juniper composite signs



Composite signs are made from recycled plastic and all parts of low-value juniper trees, which are overabundant in the southwestern United States.

Water filters



Culvert filter unit

Low-cost filters made from wood and agricultural fibers can remove significant levels of contaminants from water.



Cranberry bog tail waters

Energy and biomass



The small trees crowding our forests and other types of biomass are an abundant source of energy.

Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply

April 2005




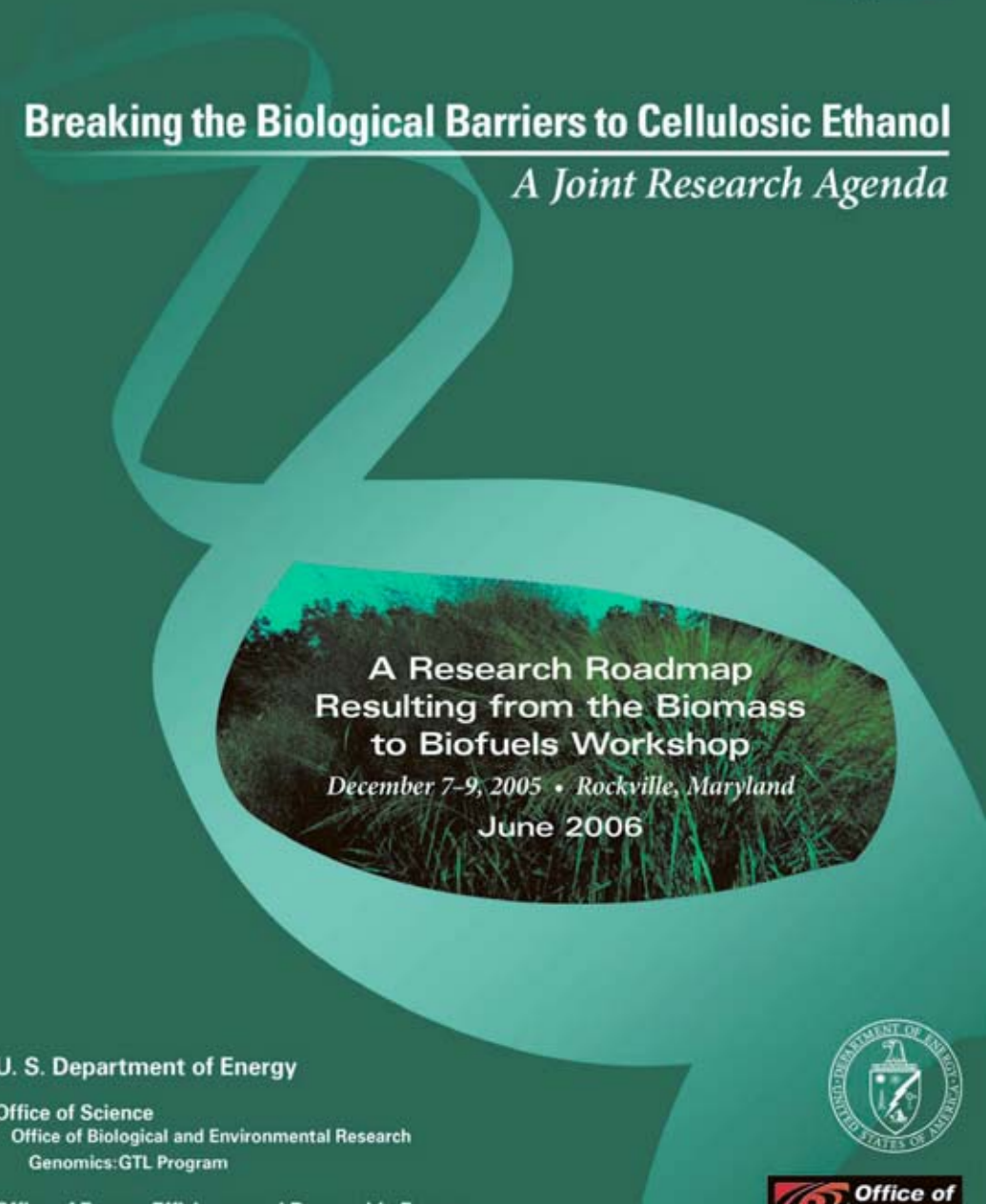
U.S. Department of Energy



U.S. Department of Agriculture

Breaking the Biological Barriers to Cellulosic Ethanol

A Joint Research Agenda



A Research Roadmap Resulting from the Biomass to Biofuels Workshop

December 7-9, 2005 • Rockville, Maryland

June 2006

U. S. Department of Energy

Office of Science

Office of Biological and Environmental Research

Genomics:GTL Program

Office of Energy Efficiency and Renewable Energy

Office of the Biomass Program



Agenda 2020 Focus for the Future

Meeting the Challenge of Deployment

Positively impacting the environment

- Significant reduction in greenhouse gases
- Decreased ecological footprint

CO_2

O_2



Next generation fiber recovery and utilization

- Recycled fiber indistinguishable from virgin fiber



Advancing the wood products revolution

- Improved building systems
- Reduced system costs

Breakthrough manufacturing technologies

- Major manufacturing cost/capital reduction
- Significant enhancement in product properties with existing assets
- Substantial improvement in energy efficiency for existing processes

Advancing the forest "bio-refinery"

- Sustainable forest productivity
- Extracting value prior to pulping
- New value from residuals and spent liquors



Technologically advanced workforce

- From workforce to knowledge workers in 7 years

The Forest Biorefinery

Today's industry situation

- U.S. forest products industry is an important and vital segment of the nation's economy
 - World's largest manufacturer of forest products
 - Directly employs over 1.3 million
 - Ranks among top 10 manufacturing employers in 42 states
 - \$50 billion estimated payroll
 - Sales top \$230 billion annually in U.S. and export markets

The Forest Biorefinery

Today's industry situation

- Forest products industry has not earned its cost of capital in a decade
- Mergers and acquisitions
 - Necessary for survival
 - Won't solve major problem

The Forest Biorefinery

Today's industry situation

- The world has changed
 - Tropical pulp mills have advantage in HW market
 - China: modern, high-technology, low-cost mills
 - Growing competition from foreign-made products in U.S. market
- Choices
 - Allow production (and supply chains) to migrate offshore
 - Introduce new line of products to provide significant growth

The Forest Biorefinery

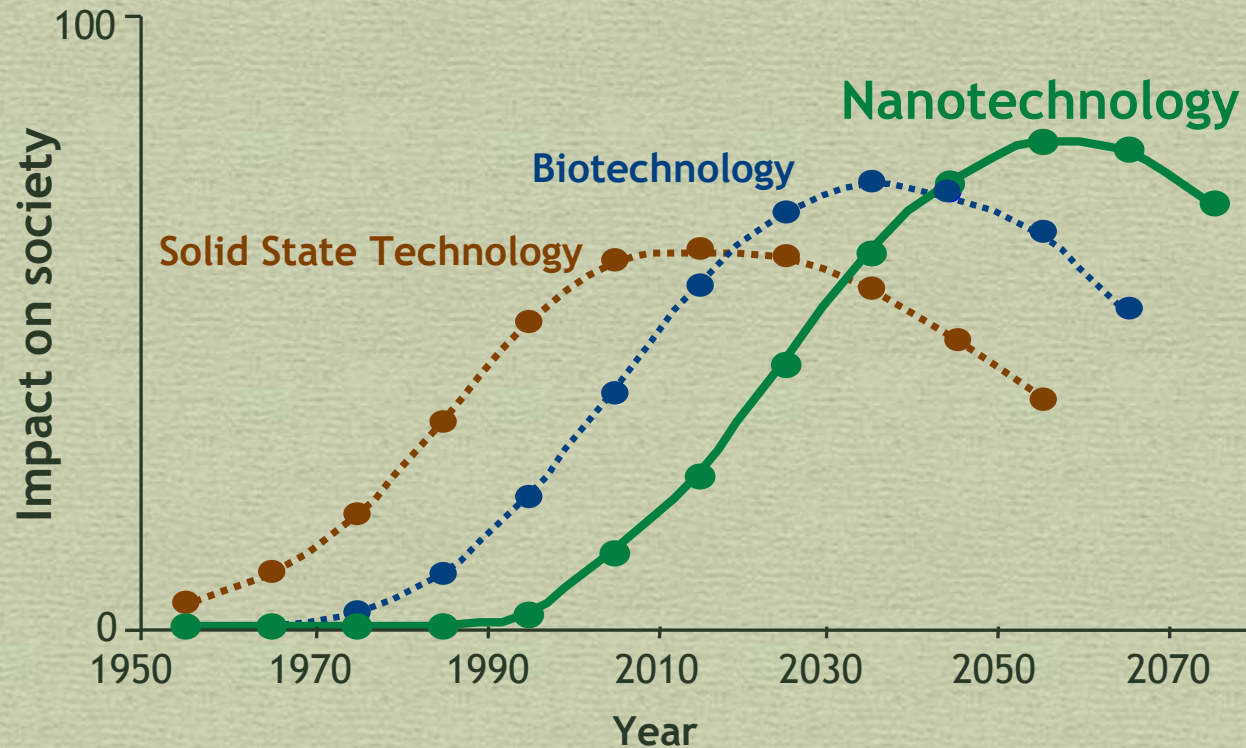
GOAL: Evolve existing pulp mills into forest biorefineries

- Produce fuels, chemicals, and power streams
- Meet growing demands for traditional pulp and paper products
- Increase revenue while protecting core business
- Excellent alignment with mandates of government agencies striving to improve nation's energy self-sufficiency
- Help preserve infrastructure, jobs, supply chains and permits

Nanotechnology

“The Next Industrial Revolution”

Dr. R. Siegel

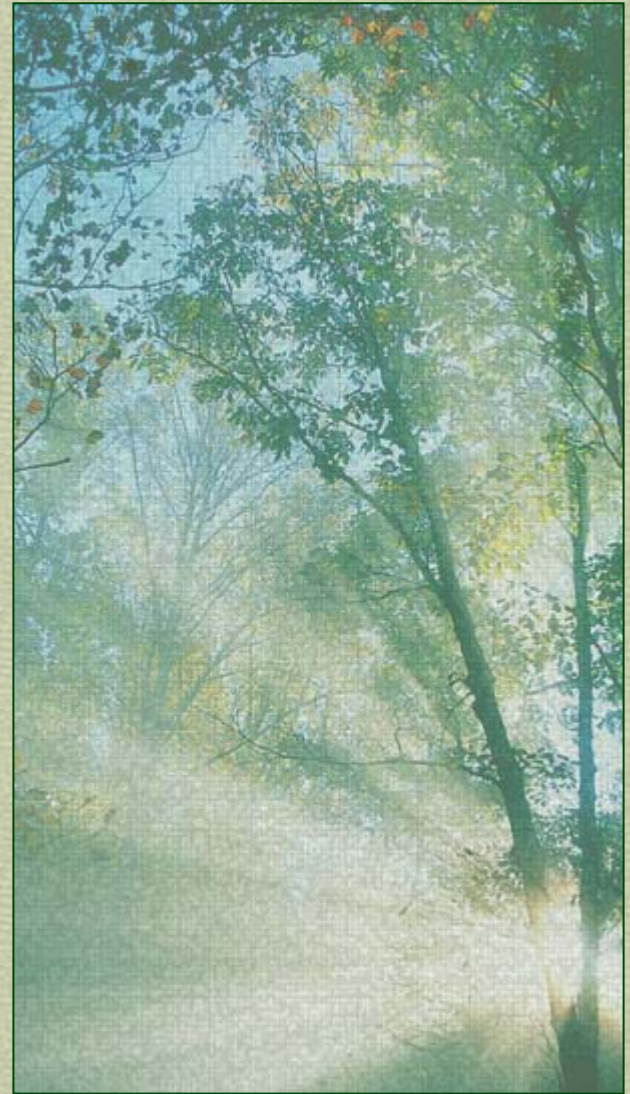


Source: ten Wold 1998

Nanotechnology: 1 to 100 nm

Why the forest products industry sector?

Trees are photochemical factories that naturally produce raw materials—including potentially useful nanoscale cellulose fibrils—from sunlight, water, and carbon taken from the atmosphere and soil.



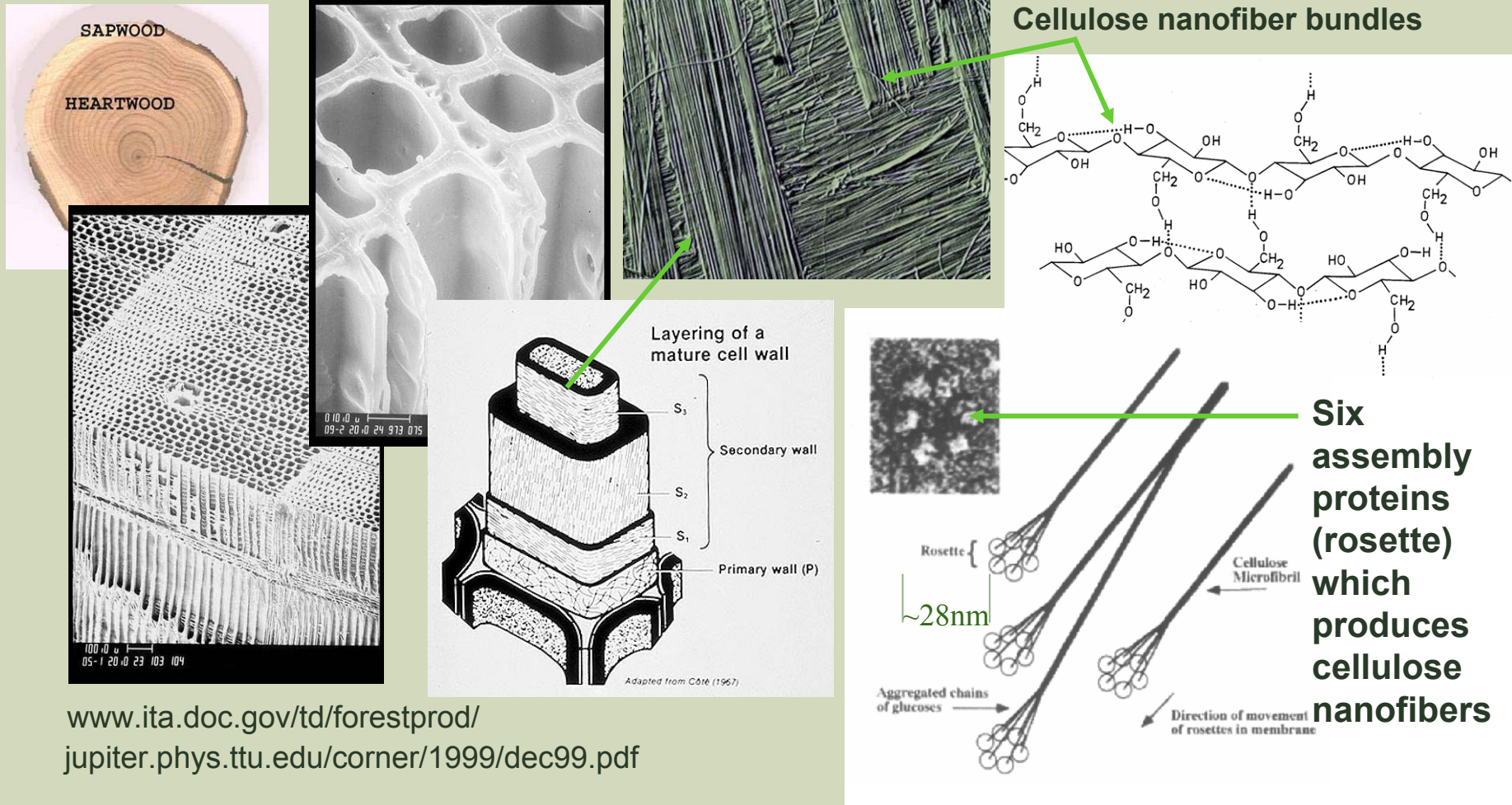
Focus Areas

- Cellulose nanofibers
 - 2-5 nm diameter
 - Fraction of strength of carbon nanotubes
- Lighter weight, higher strength paper
 - Interactions at nanoscale
 - Nano building blocks
 - Nanophotonics

Focus Areas (cont.)

- Forest products nanocomposites
 - Renewable, recyclable resources
 - Nano building blocks
- Water/cellulose interactions
 - Hydrophilic/hydrophobic switches
 - Dimensional stability of wood and paper
 - Dewatering in papermaking process

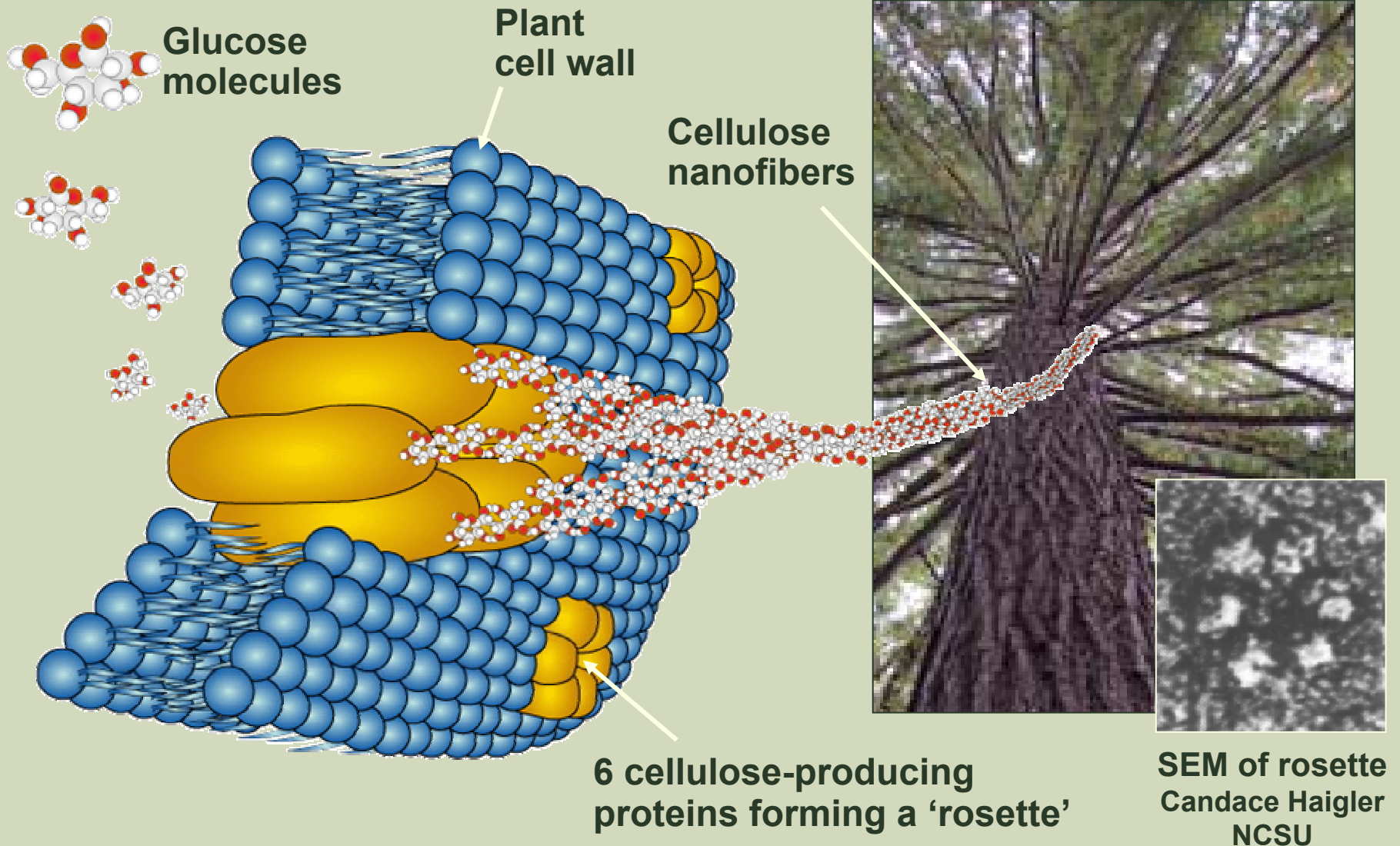
Cellulose Synthesis and Material Production: Nature Working Across a Length Scale $>10^{10}$!



[www.ita.doc.gov/td/forestprod/
jupiter.phys.ttu.edu/corner/1999/dec99.pdf](http://www.ita.doc.gov/td/forestprod/jupiter.phys.ttu.edu/corner/1999/dec99.pdf)

Candace Haigler and Larry Blanton, *Cellulose: "You're surrounded by it, but did you know it was there?"*

Cellulose Synthesis Proteins: Nature's Molecular Assembly Machines



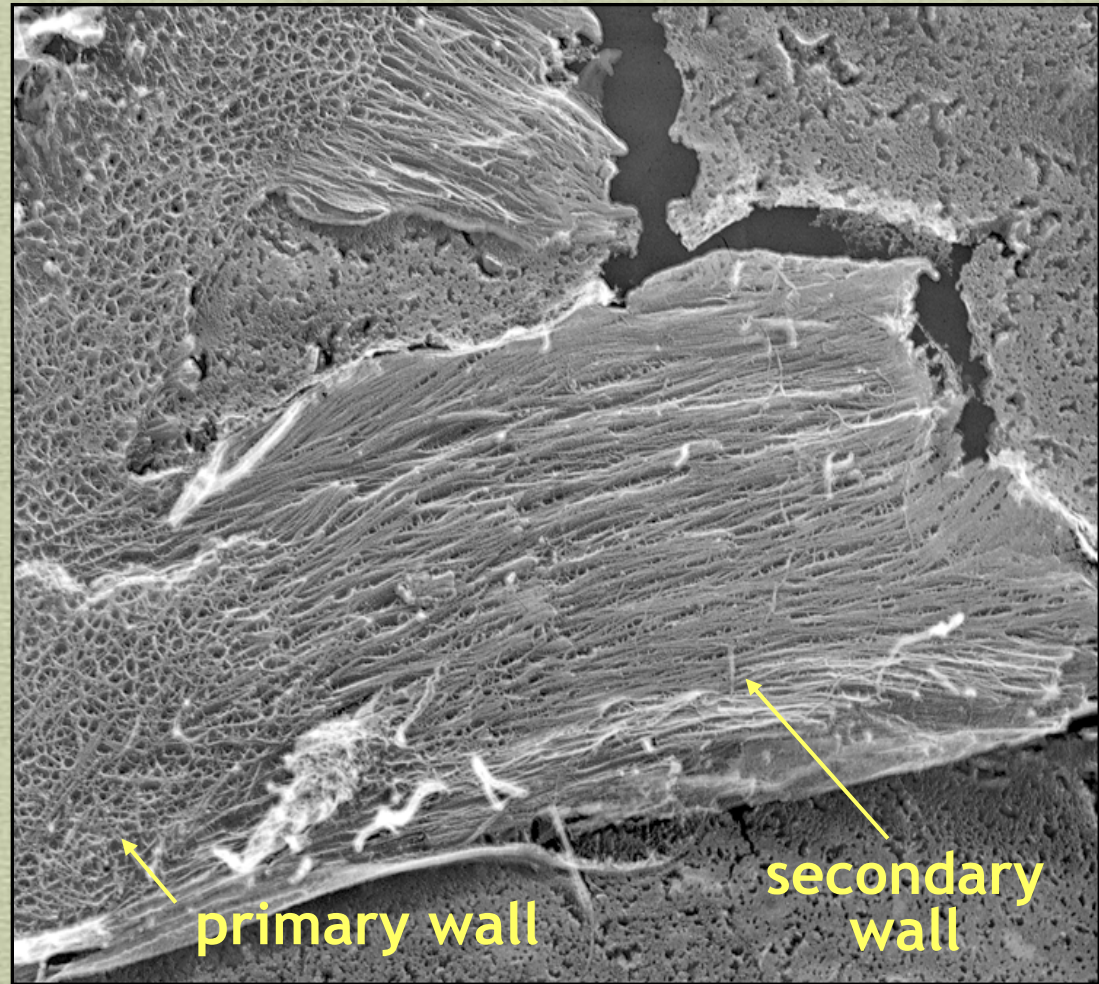
What other nanotechnologists seek to create,
we seek to understand and manipulate

Functional
nanodevices

high surface area
materials

dispersions and
coatings

consolidated
material



Forest Products Laboratory

*Conserving
the
forest
resource*

